TEXAS AGRICULTURAL EXPERIMENT STATIONS
FORT WORTH FEEDING STATION

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Feeding Experiments With Steers and Hogs

BY

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INTRODUCTION.

The Southern farmer and feeder has one great advantage in the economical production of live stock—that is the abundance of comparatively cheap protein feed in the form of cottonseed meal. For many years it has been the custom of the practical cattle feeders in the State to feed a mixture of cottonseed meal and hulls to the exclusion of all other feeds. The reason for this has been entirely a commercial one; because he has found by practical experience that hardly any other feed will yield the same net returns. The meal is, of course, a high concentrate. The hulls are fed more as a filler and with the purpose of regulating the digestion of the meal and thereby maintaining the health and vigor of the animal. The practice has been to feed all that the animal would eat without injury, and while this is successful so far as turning out a well-finished animal in a reasonable length of time is concerned, it would appear to some extent to be wasteful, because a considerable part of the feed passes through the animal undigested. That is to say, the manure from cattle fed on a mixture of cottonseed meal and hulls is exceedingly rich in nitrogen. Of course, if this manure were always saved and turned back to the cultivated fields, or if the cattle were fed on fields that were to be put in cultivation during that season, the loss would amount to little. It is interesting to note that this plan of feeding on cultivated fields is coming more and more into practice as the value of the manure is more generally and specifically appreciated. But, even under this plan of feeding, there is considerable loss of manure by reason of the fact that the ground is frequently not level, and the heavy rains wash away the plant food. In other cases the manure is allowed to remain on the surface of the ground instead of being plowed under, until there occurs a considerable loss through fermentation and solution. One of the problems, then, that the intelligent stock feeder should consider would be the proper balancing of cottonseed meal, a feed very high in protein, with some other feed rather high in carbohydrates, and then using the cheapest filler possible that would promote the digestion and health of the animal. With this in view, the Station undertook to investigate the influence of rough red rice when combined with cottonseed meal and the relative value of such a feed as compared to Kaffir corn (stalk and heads) with cottonseed meal.

The feeding test, however, was not confined to steers, but a similar object was sought in a feeding test with hogs. In this case cottonseed meal as a protein feed was combined with corn chops as the carbohydrate, in comparison with cottonseed meal and rough red rice. With another lot of pigs tankage was tested against cottonseed meal, using rough red rice as the carbohydrate. In still the fourth pen, alfalfa meal was tested against cottonseed meal with rough red rice as the carbohydrate, and, in Lot 5, alfalfa meal and corn chops, the corn chops being used, of course, against rough red rice. The extreme size and varied climatic conditions of Texas makes it profitable to select feeds in one section of the State that could not be used in another, on account of the long freight haul. Thus in the Rice Belt, along the Gulf Coast,

it may be possible to replace corn with rough red rice as a carbohydrate basis of feed for either steers or hogs, using cottonseed meal with the necessary roughage or filler to supplement the concentrates. In the Panhandle and western part of the State, Kaffir corn and milo maize along with cottonseed meal would probably be the most desirable feed. But in a Station feeding test the freight rate is eliminated, and the feeds are put upon their actual commercial value.

As indicated above, the feeds discussed in this bulletin are cottonseed meal, cottonseed hulls, Kaffir head forage, rough red rice, corn chops, tankage, alfalfa meal, and Johnson grass hay. In addition to these, a short test was made, and is here reported, with cold pressed cottonseed cake, as compared to cottonseed meal and cottonseed hulls. Some of these feeds were high priced, and the experiments with Kaffir corn forage could not be completed, because the feed could not be obtained in sufficient quantity. The rough red rice used in the feeding test was purchased in Beaumont, at a cost of $2.00 per sack (162 pounds). This price was somewhat higher than the average selling price at a little later date, and higher than the rice could have been bought for early this season, so that allowance must be made for this in determining the value of the rice as a feedstuff. The Kaffir corn, consisting of the whole stalk (grain and forage), was purchased at Chillicothe, at a cost of $12 per ton. It was free from weeds, but was a little below the average grade of the crop. The cottonseed meal and hulls were bought on the Fort Worth market at a cost of $30 and $10 per ton, respectively. The Johnson grass hay was inferior. It was impossible to get any choice hay or even hay of average quality in considerable quantity during last season, owing to the great drouth prevailing over the State. But, as it was, it cost $17.50 per ton.

STEER FEEDING EXPERIMENTS.

USES OF CONSTITUENTS OF FEED.

It is the amount of *digestible* nitrogen-free extract or carbohydrates, and the ether extract or the fat or oil, and the protein or nitrogenous portion of a feed that gives it what value it may possess for fattening animals. A pound of fat is equal to $2\frac{1}{4}$ pounds of carbohydrates. Authorities are not agreed as to the amount of protein a fattening animal should receive; however, it is the sole source of muscular growth, and is used for other purposes. Growing animals need much more protein than maturer ones, and it is because of the relatively low proportion of protein—some feeds, such as Indian corn that practical feeders have come to prefer some feed such as cottonseed meal, wheat bran or shorts, along with corn for young growing stock.

Crude fiber is made up of the woody portions of a feed. Wheat and corn bran contain considerable amounts of crude fiber. Crude fiber is largely indigestible, and on this account it is desirable to have as little as possible of this constituent in any feedstuff. Digestible crude fiber is practically of the same feeding value as nitrogen-free extract.

The following tables will be of assistance in understanding more fully the uses of constituents of feed:

TABLE I.—COMPOSITION OF COTTONSEED MEAL, COTTONSEED HULLS, KAFFIR FORAGE, ROUGH RED RICE AND JOHNSON GRASS HAY.

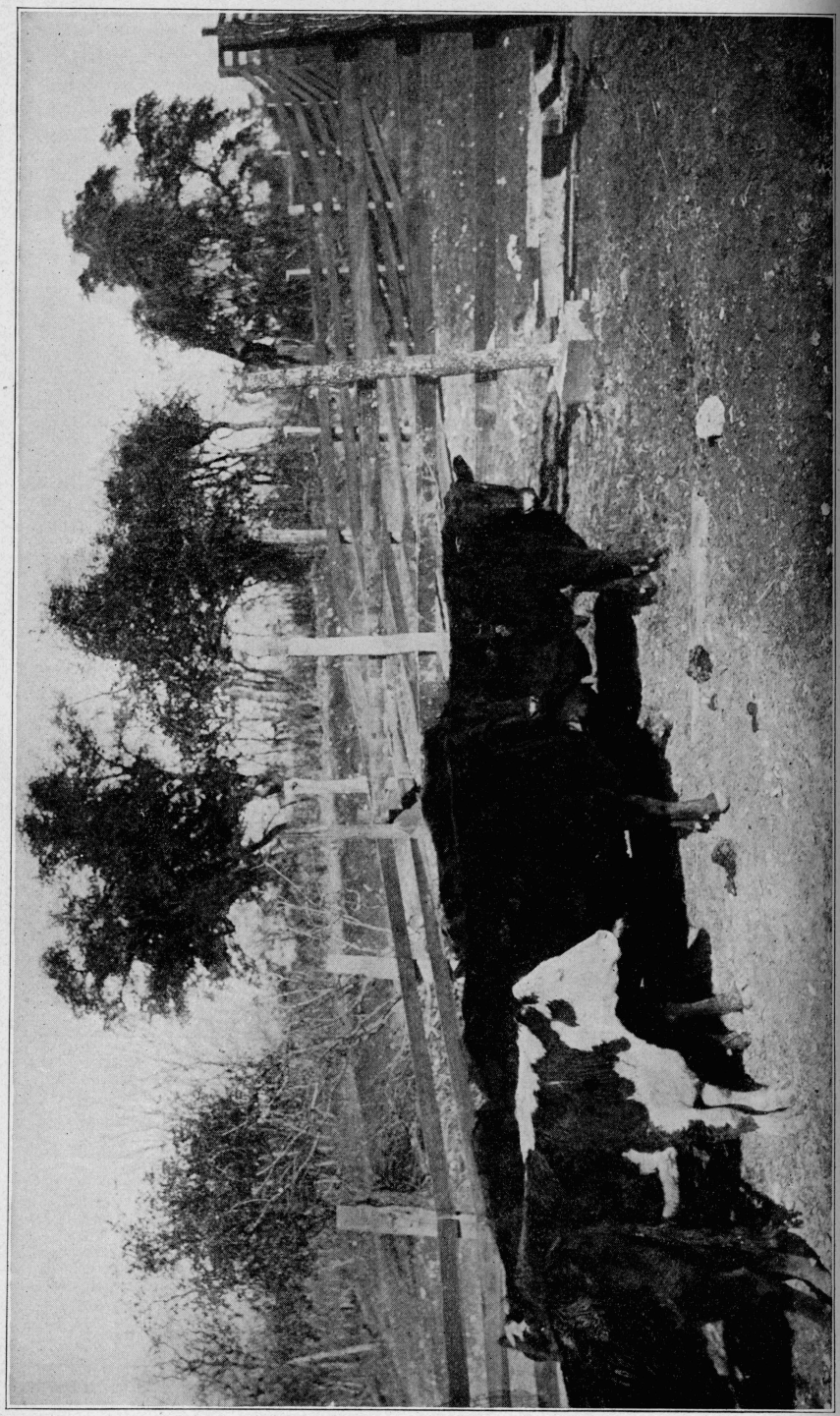
	Percentage composition.					
	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Water.	Ash.
Cottonseed meal	47.93	10.21	7.07	22.48	6.87	5.38
Cottonseed hulls	4.55	1.79	46.75	35.25	9.21	2.45
Kaffir forage						
Rough red rice	8.25	2.10	10.00	63.88	9.39	6.38
Johnson grass hay	7.20	2.10	28.50	45.90	10.20	6.10

TABLE II.—DIGESTIBLE CONSTITUENTS IN COTTONSEED MEAL, COTTONSEED HULLS, KAFFIR FORAGE, ROUGH RED RICE AND JOHNSON GRASS HAY.

	Digestible nutrients in 100 pounds.			
	Total dry matter in 100 lbs.	Protein.	Carbohydrates.	Ether extract.
Cottonseed meal	91.8	37.2	16.9	12.2
Cottonseed hulls	88.9	0.3	33.1	1.7
Kaffir forage	About 80.0	10.0	60.0	3.0
Rough red rice	100.0	4.6	61.9	0.2
Johnson grass hay	Unknown	Unknown	Unknown	Unknown

KAFFIR FORAGE AS A STEER FEED.

In connection with this experiment, it would certainly be unfair to the Kaffir forage and to that section of the State so admirably adapted



Steers receiving cottonseed meal and cottonseed hulls.

to its production to leave the reader free to draw conclusions as to the feeding value of Kaffir forage without a fair statement of the conditions under which it was fed.

The Kaffir forage was of excellent quality, but could not be bought on the market in a shredded condition, and because of a lack of necessary equipment it was impossible to shred it here at the Station; therefore, it was fed unheaded and unshredded. During a feeding period of thirty-four days, sixteen thousand nine hundred and sixteen pounds of Kaffir forage was fed to two lots of eight steers each; thirteen hogs, averaging one hundred and fifteen pounds, were allowed to follow the steers, and the amount of undigested Kaffir corn passing through the steers was more than the hogs would clean up. Fully 50 per cent of the Kaffir corn eaten by the steers passed through undigested. With such large loss of feed, fair or even average gains could not be expected. When the records were checked, it was found that Lot I had gained 890 pounds, while Lot II had gained 575 pounds, or an average daily gain of less than 1.7 pounds.

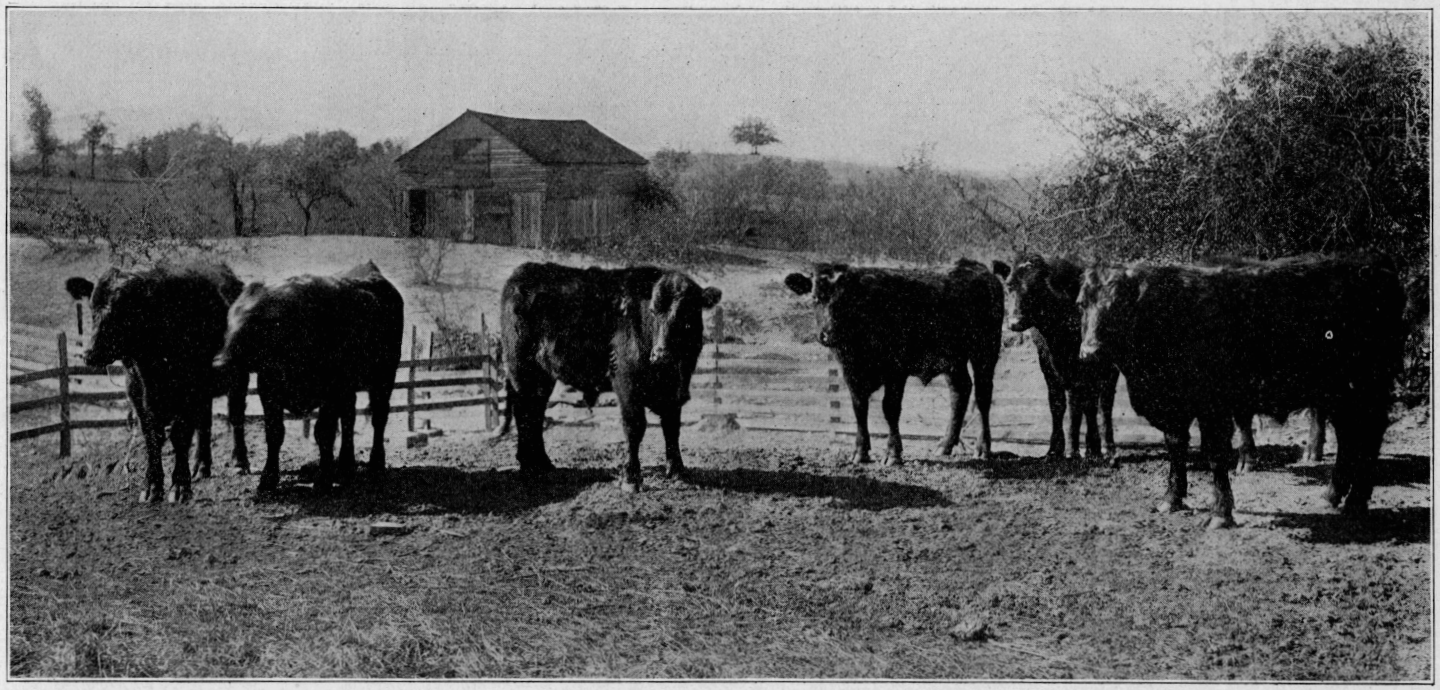
Because the steers had not gained as they should have done under favorable circumstances, and, also, because it was practically impossible to buy any more Kaffir forage this late in the season (March 9, 1910), our supply being exhausted, it was decided to take the Kaffir forage from the ration and substitute something else. This substituted ration is discussed at another place in this Bulletin.

Though this showing made by the Kaffir forage is unprofitable, we do not believe that our experience would justify an unfavorable report, but we believe it would be a profitable feed if the heads were previously ground and the stalks shredded.

ROUGH RED RICE AS A STEER FEED—PRELIMINARY STATEMENT.

Within recent years, Texas has been producing an immense quantity of rice, a varying per cent of which is an inferior grade and, therefore, can not be marketed for table use. This inferior or *"rough red rice,"* as it is termed, has been placed on the market as a feedstuff. In some instances, it has been highly recommended for feeding stock of all kinds. Hence, it was decided to give it a trial in a ration for fattening steers. Lot III was selected for this purpose, and eight steers were fed a ration of cottonseed meal, *rough red rice* and *Johnson grass* hay from February 4th until the close of the experiment. Their first day's ration consisted of 48 pounds of rice, 16 pounds cottonseed meal, and as much Johnson grass hay as they would clean up. For the first thirty-four days of the experiment the rice was fed unground, and a large per cent of it passed through the steers undigested. The steers scoured badly, and, in some instances, bloated; both conditions attributed to the indigestibility of the rice. At the end of the first eight days the ration was reduced from 48 to 32 pounds of rice; still the steers continued to scour and bloat, until finally it was decided to buy a mill and grind the rice before feeding it. On March 10th, we begun feeding the same amount (32 pounds) of ground rice daily to the eight steers. The steers immediately stopped scouring and bloating and soon began to show better gains and always met the feed wagon.

On March 9th, when the Kaffir forage was taken away from Lot II



Steers received cottonseed meal, rough red rice, and Johnson grass hay at the beginning of the experiment.

and rough red rice and cottonseed hulls substituted, the steers stopped scouring and bloating. This fact alone would seem to substantiate our belief that the scouring and bloating of the steers in Lot II was due directly to the indigestibility of the unground rice.

The results obtained in these feeding tests indicate that rough red rice, in combination with certain other feeds, can be fed profitably to steers.

LINE OF EXPERIMENT.

On February 4th, the steers were divided into three lots, each lot containing six Poll Angus and two Herefords. Each lot was fed ninety days.

Lot II received a ration of cottonseed meal and Kaffir corn forage from February 4th until March 9, 1910, when the ration was changed to a mixture of cottonseed meal, rough red rice, and cottonseed hulls. Lot III was fed a ration of cottonseed meal, rough red rice and Johnson grass hay during the entire ninety days. Lot IV received a ration of cottonseed meal and hulls throughout the experiment. They were confined to pens and were supplied with an abundance of fresh water. They were salted once or twice each week.

At the beginning of the experiment, the total weight of Lot II was 7550 pounds, Lot III 7860 pounds, and Lot IV 7960 pounds. The following table gives a summary of feed eaten, gains made, pounds of feed per pound gain, and average cost per pound gain.

LOT II.

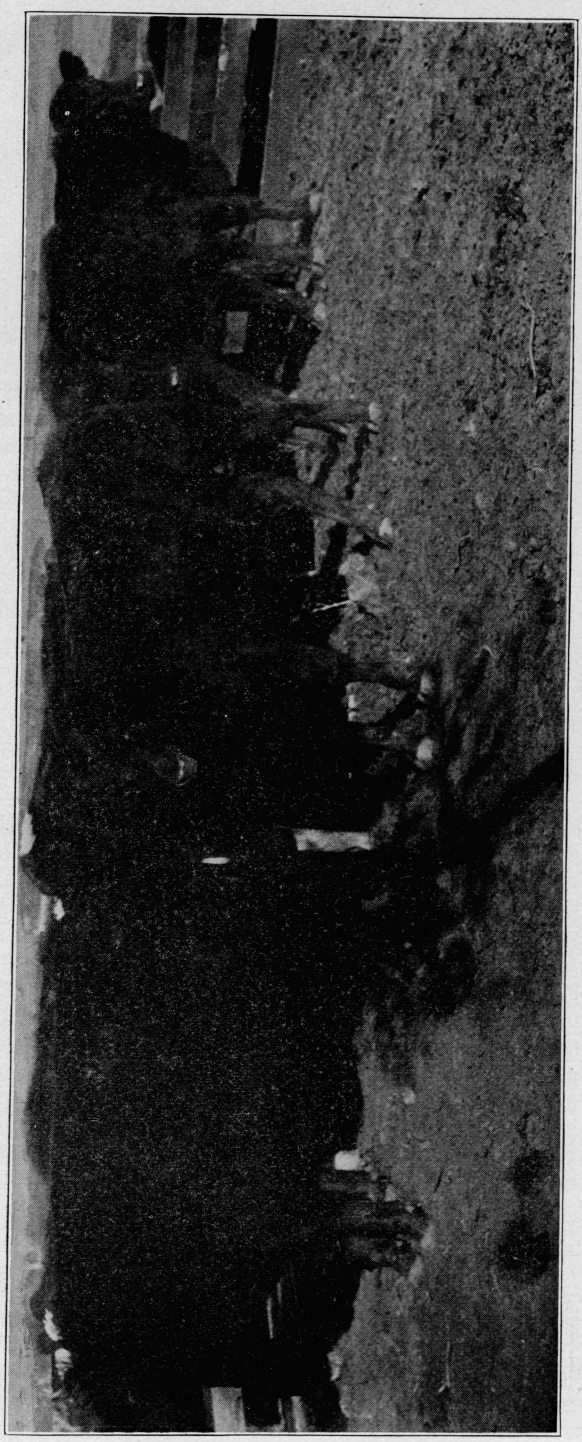
Average weight of steers Feb. 4, 1910.	Feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Average cost per lb. gain.
943.7 lbs.	2920 lbs. cottonseed meal; 9800 lbs. hulls; 2624 lbs. rice; 8528 lbs. Kaffir forage.	1910 lbs.	1.5 bbls. cottonseed meal; 5.1 lbs. hulls; 44 lbs. Kaffir; 1.4 lbs. rice.	2.7 lbs.	9.16 cts.

LOT III.

Average weight of steers Feb. 4, 1910.	Feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Average cost per lb. gained.
982.5 lbs.	5222.9 lbs. rice; 3000 lbs. cottonseed meal; 9040 lbs. Johnson grass hay.	1580 lbs.	3.43 lbs. rice; 1.9 lbs. cottonseed meal; 5.7 lbs. Johnson grass hay.	2.19 lbs.	12.29 cts.

LOT IV.

Average weight of steers, Feb. 4, 1910.	Feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Average cost per lb. gained.
995 lbs.	3592 lbs. cottonseed meal; 19,664 lbs. cottonseed hulls.	1760 lbs.	2.04 lbs. cottonseed meal; 11.12 lbs. cottonseed hulls.	2.44 lbs.	8.72 cts.



Steers in Lot II received cottonseed meal, cottonseed hulls, ground rough red rice, and Kaffir corn forage, at the beginning of the experiment.

The results show that Lot II, receiving cottonseed meal, Kaffir forage, rough red rice and cottonseed hulls, made a total gain of 1910 pounds, requiring 1250 pounds of feed for each 100 pounds gain; Lot III, receiving rough red rice, cottonseed meal and Johnson grass hay, made a total gain of 1580 pounds, requiring 1103 pounds of feed for each 100 pounds gain; while Lot IV, receiving cottonseed meal and hulls, made a total gain of 1760 pounds, requiring 1316 pounds of feed for each 100 pounds gain.

KIND OF CATTLE.

Eighteen grade Angus and six grade Hereford steers of as near one weight and quality as possible were bought of the Cassidy Southwestern Commission Company, purposely for the tests reported in this Bulletin. The steers had been fed a ration of corn and were in a fair marketable condition, they were three-year-olds and averaged nine hundred and forty-seven (947) pounds. These cattle were fairly gentle, but not exceptionally so, and from the first ate freely of the feed kept before them.

SALE OF STEERS.

On May 4th, the steers were put on the market and sold without the buyer having any knowledge as to the feed given each lot. Lot II brought $7.25; Lot III brought $7.00; Lot IV brought $7.50 per 100 pounds, respectively.

BLOCK TEST.

After the steers had been killed, dressed and sent to the cooler, the carcasses were cut in a manner to show the muscle and fat development. The cuts were made in front of the shoulders, between the fifth and sixth ribs, and across the loins, respectively. The first thing noted in handling the carcasses was the firmness of flesh of all three lots. The lean meat in the carcasses of the lot fed straight cottonseed meal and hulls was the brightest cherry red and the grain of the flesh, or size of muscle fiber, was much finer and the fat more evenly distributed than in either Lot II or Lot III. The flesh of the latter two lots was more of a pale red or chocolate color and was not interwoven with those little pieces of fat which are so numerous and so evenly distributed throughout the carcass of a steer that "kills well." As far as quality of the meat was concerned, Lot IV was superior to that of either of the other lots. However, Lots II and III dressed a higher per cent, respectively. This discrepancy is accounted for mainly in difference of intestinal fat found in the steers making up Lots II and IV.

DISCUSSION OF RATIONS FED.

The results obtained in feeding the three lots of steers, leads to a careful consideration of the rations fed. The following table gives the composition of the feeding stuffs making up the rations and the per cent of digestible nutrients. Credit is due the Chemical Section of the Texas Experiment Stations, Dr. G. S. Fraps, Chief Chemist, for the analyses of the cottonseed meal, cottonseed hulls and the rough red rice

used in this experiment. The analyses of the Kaffir forage and the Jonson grass hay and the digestible nutrients of the several feeding stuffs are from tables showing average analyses.

FINANCIAL OUTCOME.

TABLE SHOWING EXPENDITURES AND RECEIPTS FOR THE ENTIRE EXPERIMENT.

	Cost of feed consumed.	Total cost.	Proceeds.	Value of steers at beginning.	Balance net profit.
Lot II	$ 176 37	$ 561 42	$ 685 85	$ 385 05	$ 124 43
Lot III	198 73	585 10	660 80	400 86	61 21
Lot IV	152 20	538 57	729 00	405 96	170 84

COLD PRESSED COTTONSEED CAKE AND COTTONSEED MEAL AND HULLS IN THE PRODUCTION OF BEEF.

On April 12th, eight steers, divided into two lots, were put on feed. These steers had been fed on a ration of cottonseed meal, rough red rice and Kaffir forage from February 4th until March 9th, when the Kaffir forage gave out, and the ration was changed to rough red rice, cottonseed meal, Johnson grass hay and a small quantity of corn chops, one pound of corn chops to each steer, was added to the ration and thoroughly mixed with the rice and cottonseed meal and proved to be an excellent appetizer. This ration was fed until April 12th, when the eight steers were divided into two lots: Lot I was fed a ration of cold pressed cottonseed cake and Johnson grass hay, while Lot II was fed a ration of cottonseed meal and hulls.

KIND OF CATTLE.

The steers used in the test were bought of the Cassidy Southwestern Commission Company, of Fort Worth, at the same time as those used in the experiments just reported. There were eight in all and they consisted of six grade Poll Angus and two grade Herefords. They were three-year-olds, and had been fed a ration of corn and were in a fair marketable condition at the time the experiment commenced. They averaged 947 pounds in weight.

LINE OF EXPERIMENT.

On February 4th, these eight steers were put on a ration of rough red rice, cottonseed meal, and Kaffir forage, and continued eating this ration until March 9th. The results are given in the following table:

TABLE I.

Average weight of steers, Feb. 4, 1910.	Feed eaten.	Total gain.	Average daily gain.	Lbs. feed per lb. gain.	Average cost per lb. gained.
952.5 lbs.	1216 lbs. rice; 680 lbs. cottonseed meal; 7270 lbs. Kaffir forage.	480 lbs.	1.76 lbs.	1.36 lbs.	

From Table I, it will be seen that the steers made very poor gains. The rice was fed unground and passed through the cattle largely undigested, and had a tendency to bloat and scour them. The Kaffir forage was fed unheaded and unshredded, and fully 50 per cent of it was undigested, and, therefore, of little value to the steers. Had the Kaffir forage been unheaded, heads ground, the stalks shredded, and the rice ground before feeding it, this might have probably proved to be the most economical ration for the production of beef fed at the Station the past winter.

After March 9th, these same steers were fed a ration of rough red rice, cottonseed meal, Johnson grass hay and a small quantity of corn chops, one pound each per day, until the 12th of April. The results are shown in the following table:

TABLE II.

Average weight of steers, March 9, 1910.	Feed eaten.	Total gain.	Average daily gain.	Lbs. feed per lb. gain.	Average cost per lb. gain.
1063.75 lbs.	Cottonseed meal, 1048 lbs; rice, 1552 lbs.; corn chops, 264 lbs.	620 lbs.	2.35 lbs.	Cottonseed meal 128 lbs.; rice, 1.9 lbs. corn chops. .33 lbs.; Johnson grass hay 4.03 lbs.	8.56 cts.

From a study of the tables, it will be seen that the steers made better average gains while eating the above ration than they gained on any of the other rations during the same length of time, with the exception of Lots II and IV. The rice was being ground, the small amount of corn chops mixed with the cottonseed meal and rice served as an excellent appetizer, and the steers were always ready and willing to eat. The average daily gain during this period was higher than that of any other single lot during the same length of time. This higher average daily gain of the steers while eating this ration is attributed almost entirely to the fact that, after March 9th, the rice was fed ground and was, therefore, more digestible, and, aside from this, the steers were not troubled by bloating or scouring, as they had previously done while eating the unground rice.

On April 12th, the same eight steers used in the two previous tests were divided into two lots of so near one size, weight and quality as possible. Lot I was fed a ration of cold pressed cottonseed cake and Jonhson grass hay, while Lot II was fed a ration of cottonseed meal and hulls.

It will be observed that the experiment was conducted during the latter part of the spring, undoubtedly too late to secure the best results.

The record of the two lots is given as follows:

Average weight of steers, April 12, 1910.	Feed eaten.	Total gain.	Average daily gain.	Lbs. feed per lb. gain.
Lot I, 1087.5 lbs.	5,376 lbs. cold pressed cotton seed cake; 3322.7 lbs. Johnson grass hay.	270 lbs.	1.25 lbs.	19.91 lbs. cold pressed cottonseed cake; 12.3 lbs. Johnson grass hay.
Lot II, 1092.5 lbs.	5702 lbs. cottonseed hulls; 1358 lbs. cottonseed meal.	190 lbs.	.85 lbs.	7.15 lbs. cottonseed meal; 30.01 lbs. cottonseed hulls.

Both of these feeds, at least one of them a standard, gave very unsatisfactory returns, but this was in part due, perhaps, to the hot weather and to the large number of flies, both of which were very trying on the steers during the last twenty or thirty days of the experiment. But principally to the fact that the steers were already in a good marketable condition.

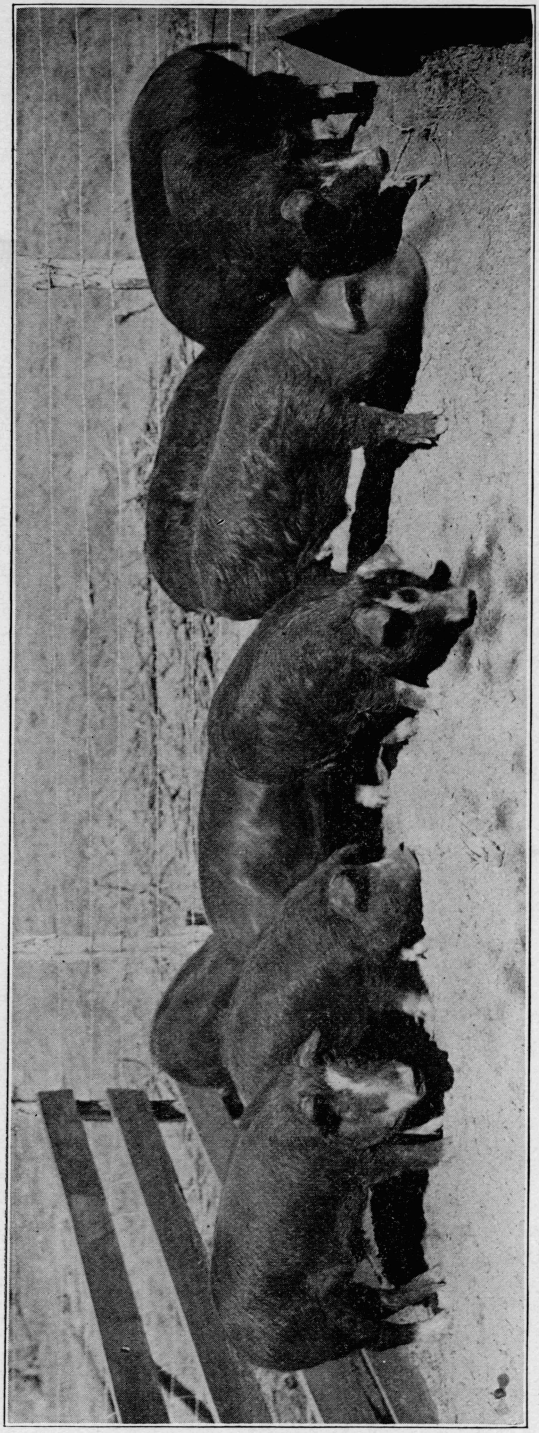
The extra gain of Lot I over Lot II is most likely due directly to

assimilation rather than to the cold pressed cottonseed cake, being in the form of a cake as it is, the steers were compelled to thoroughly masticate it, and, therefore, could not gulp it down to the extent that the cottonseed meal and hull steers gulp down the cottonseed meal, when it happens not to be thoroughly mixed with the hulls. Even though the cottonseed meal and hulls are thoroughly mixed, some of the steers will at times get too much of the cottonseed meal and, as a result, either bloat or scour. With this fact in favor of the cold pressed cottonseed cake, it is very doubtful whether it can ever be fed alone profitably, owing to its high cost, but, if fed in combination with other concentrates, such as shelled or ground corn, it would probably prove to be an economical feed.

The form of the cold pressed cottonseed cake and the convenience with which it may be fed, are two items, which, in our opinion, will make it a favorite feed with the small dairyman and with people who have but one or two milch cows.

SUMMARY.

1. While our experiments with Kaffir forage were unprofitable, we believe it would be a profitable feed for fattening steers if fed with heads ground and stalks shredded.
2. Rough red rice in a mixed ration of cottonseed meal and hulls gave better daily gains than a straight meal and hull ration, but not cheaper.
3. When the price of Johnson grass hay is reasonably low, it can be fed profitably as a roughage to fattening steers.
4. It is apparent that none of the feeds used, at the price paid, can economically take the place of cottonseed meal and hulls for fattening steers.
5. Johnson grass hay at $17.50 per ton proved to be a more economical roughage than Kaffir forage (heads unground and stalks unshredded) at $12 per ton for fattening steers.
6. Cold pressed cottonseed cake at $25 per ton can not profitably take the place of cottonseed meal at $30, and hulls at $10 per ton, for fattening steers.
7. Cold pressed cottonseed cake and Johnson grass hay gave higher daily gains than cottonseed meal and hulls, but at a much greater cost.
8. Feeding should begin early in the fall.



Hogs receiving cottonseed meal and rough red rice, ground and fermented. Average daily gain, 1.4 pounds.

HOG FEEDING EXPERIMENTS.

INTRODUCTION.

During the last year or two the industry of hog raising in Texas has developed to a remarkable degree. There is scarcely a farmer in the State who is not more or less interested in the hog business. In fact, the demand for brood sows throughout the State has been more than the home supply could meet, and, as a result, hundreds of farmers have been compelled to go to other States for their supply. This demand on the part of so many has been caused largely by the very high prices paid for hogs by the packers during the last year, but, if the price were to drop to 5 or 6 cents, it is probable that the number of hog raisers in the State would be materially reduced. However, the increase in the number of farmers raising hogs at the present time can not help but add many thousands of dollars annually to the valuation of hogs in the State.

At present, Texas is third among the States in number and sixth in valuation of hogs. This fact is due largely to the careless way a great number of the Texas farmers have gone into the business. Heretofore, only a very small per cent of the farmers have given their hogs any attention. In most cases they have looked upon hogs as being of little value and have been content with barely enough to supply the home with meat, and, in a great many localities where the conditions are favorable for the successful production of pork, the supply is entirely inadequate. Hog cholera is no longer a menace to the industry; and the encouragement of the present high prices, together with the stimulus which is being given to the hog industry by the packers and railroad companies of the State, gives reasonable assurance that the time is not far distant when Texas will be the leading hog State of the Union.

FEED FED.

In planning these experiments, it was our desire to use the feeds which are being most commonly fed by the farmers who are feeding hogs either for the market or for home use. We felt that if we could form rations in such way from these feeds as to increase the average daily gains or to reduce the cost of production a very small per cent, that our work here would be worth many thousands of dollars annually to the hog raisers of the State. With this idea in mind, we selected cottonseed meal, corn chops, tankage, rough red rice and alfalfa meal. These feeds were high-priced. High-grade alfafa meal could not be bought on the local market, and, since we were going to feed a very small amount, it was not thought advisable to have it shipped from a distance on account of the high freight rate. All the feeds were bought on the local market, with the exception of the rough red rice, which was bought in Beaumont, Texas.

KIND OF HOGS FED.

The pigs used in conducting these experiments were grade Poland China, grade Duroc Jersey and grade Berkshire. They were bought for the Station by the Cassidy Southwestern Commission Company of Fort Worth, and were the tops out of a car lot shipped from Lubbock, Texas, and had probably been fed a ration of either Kaffir or milo for twenty or thirty days previous to shipping. They averaged 108.4 pounds the 3d of February, when the experiment started.

LINE OF EXPERIMENT.

Fifty pigs were divided into five lots of ten each. Great care was taken to get the pigs in each pen of as near one weight, size and quality as possible. Owing to the danger usually accredited to the feeding of cottonseed meal to hogs, it was thought advisable to choose the rather inferior individuals of the lot for this feed.

The following rations were fed:

Lot I was started on 6.5 pounds of cottonseed meal and 16.5 pounds of corn chops per day. These amounts were gradually increased until the pigs were eating 12.5 pounds of cottonseed meal and 78 pounds of corn chops. The cottonseed meal and corn chops were thoroughly mixed and fermented preceding each feeding.

Lot II was started on 7.5 pounds of cottonseed meal and 16.5 pounds of unground rough red rice per day. These amounts were gradually increased until the pigs were eating 33 pounds of rice and 10 pounds of cottonseed meal per day. This is all that the ten pigs would consume up until March 10th, after which date the rice was ground. From March 10th the amount of cottonseed meal and rice were gradually increased until the pigs were eating 15 pounds of cottonseed meal and 70 pounds of rice daily. The cottonseed meal and rice was thoroughly mixed and fermented from the beginning to the close of the experiment.

Lot III was started on 5 pounds of tankage and 15 pounds of unground rough red rice per day. This tankage and rice was thoroughly mixed but fed dry until February 10th, after which date it was fermented. These amounts were increased until the pigs were eating 10 pounds of tankage and 40 pounds of rice by March 10th. On March 10th the rice was ground, thoroughly mixed with the tankage and fermented. From this time on, the rice and tankage were gradually increased to 75 and 20 pounds, respectively.

Lot IV was started on 5 pounds of alfalfa meal and 15 pounds of unground rough red rice per day. This was fed thoroughly mixed but unfermented until February 10th, after which date it was fermented. The amount of alfafa meal and rough red rice was gradually increased until on March 10th they were eating 10 pounds of alfalfa meal and 40 pounds of rice. After March 10th the rough red rice was ground and was regularly increased until the ten pigs were eating 75 pounds of rice in addition to the 10 pounds of alfalfa meal.

Lot V was started on 5 pounds of alfalfa meal and 15 pounds of corn chops. This was fed thoroughly mixed but unfermented until February 10th, after which date the mixture was fermented. These amounts

vere gradually increased until the pigs were eating 10 pounds of alfafa neal and 70 pounds of corn chops per day.

The detailed record of each lot is given in the following pages:

TABLE I.—FEED EATEN AND GAINS MADE BY LOT I RECEIVING CORN CHOPS AND COTTONSEED MEAL.

No. of pigs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Cost per lb. gain.	Balance.
10	99 lbs.	3661.5 lbs. cornchops; 916 lbs. cottonseed meal.	1505 lbs.	2.43 lbs. corn chops; .608 lb. cottonseed meal.	1.8 lbs.	4.56 cts.	$ 92 60

The first seven days these pigs were on feed they made a gain of 85 pounds, or an average daily gain of 0.85 pounds. This was their lowest gain during any single week, and their highest daily gain was during the fourth week of the experiment, when their average was 2.36 pounds. Their next highest gain was during the twelfth and last week of the experiment. Teir average daily gain for this week was 2.22 pounds. Right here, the question might justly be asked, why were they sold at this time, since they were making such excellent gains? Because they had grown to be very fat, the weather was unusually hot for that time of year, and they had begun to suffer during the mid-day from excessive heat. At no time during the experiment did any of them show any signs of sickness. They were always ready and willing to eat at feed time.

TABLE II.—FEED EATEN AND GAINS MADE BY LOT II RECEIVING COTTONSEED MEAL AND GROUND ROUGH RED RICE FERMENTED.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Lbs. seed per lb. gain.	Average daily gain.	Cost per lb. gain.	Balance.
9	131 lbs.	3950 lbs. rice; 1022.5 lbs. cottonseed meal.	1166 lbs.	3.4 lbs. rice; .88 lb. cottonseed meal.	1.4 lbs.	5.74 cts.	$ 63 90

It will be noticed that it required 0.27 pounds more of cottonseed meal and 1.03 pounds more of rice than of corn chops to produce a pound of pork. Lot I gained 4 pounds more per day than Lot II, and it cost 5.74 cents to produce a pound of gain in Lot II, while it cost but 4.56 cents to produce a pound of gain in Lot I.

On April 2d one piggy sow weighing 170 pounds was taken out of Lot II. There were no signs of sickness at any time during the experiment. These pigs did not gain well at the beginning of the experiment, gaining only 230 pounds during the first three weeks, but at the close of the experiment they were gaining at the rate of 2.37 pounds each per day, which was equal to the best daily gains made by Lot I. However, Lot I gained 1505 pounds in twelve weeks at a total cost of $68.62, while it took Lot II thirteen weeks to gain 1166 pounds at a total cost of $66.92.

Hogs fed on tankage, and rough red rice, ground and fermented. Average daily gain, 1.28 pounds.

LOT I—FRMENTED CORN CHOPS AND COTTONSEED MEAL FOR COMPARISON WITH LOT II.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Cost per lb. gain.	Balance.
10	99 lbs.	3661.5 lbs. corn chops; 916 lbs. cottonseed meal.	1505 lbs.	2.43 lbs. corn chops; .608 lb. cottonseed meal.	1.8 lbs.	4.56 cts.	$ 92 60

TABLE III.—FEED EATEN AND GAINS MADE BY LOT III RECEIVING TANKAGE AND GROUND ROUGH RED RICE FERMENTED.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Cost per lb. gain.	Balance.
9	105.5 lbs.	4509 lbs. rice; 1156.5 lbs. tankage.	1055.5 lbs.	4.3 lbs. rice; 1.1 lbs. tankage.	1.28 lbs.	7.6 cts.	$ 41 33

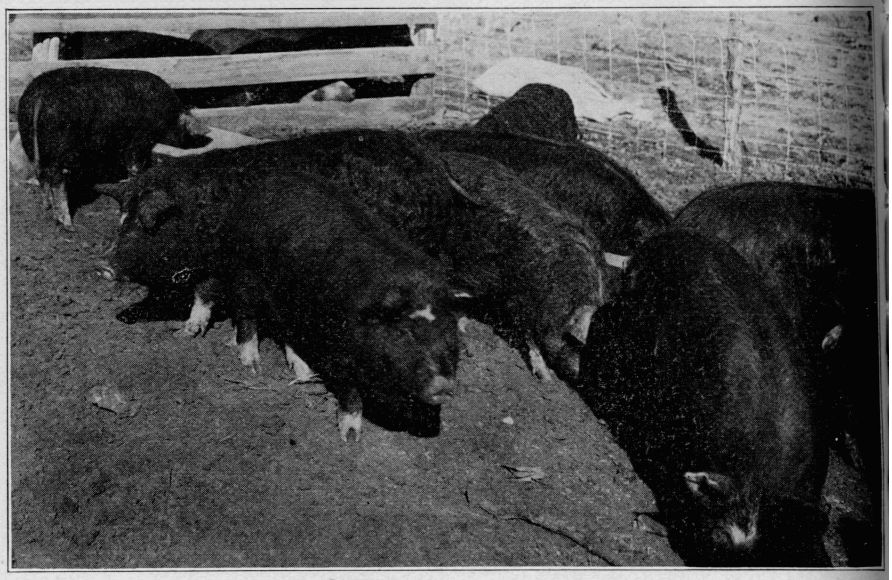
LOT II—FERMENTED COTTONSEED MEAL AND ROUGH RED RICE FOR COMPARISON WITH LOT III.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Lbs. feed per lb. gain.	Average daily gain.	Cost per lb. gain.	Balance.
9	131 lbs.	3950 lbs. rice; 1025.5 lbs. cottonseed meal.	1166 lbs.	3.4 lbs. rice; .88 lb. cottonseed meal.	1.4 lbs.	5.74 cts.	$ 63 90

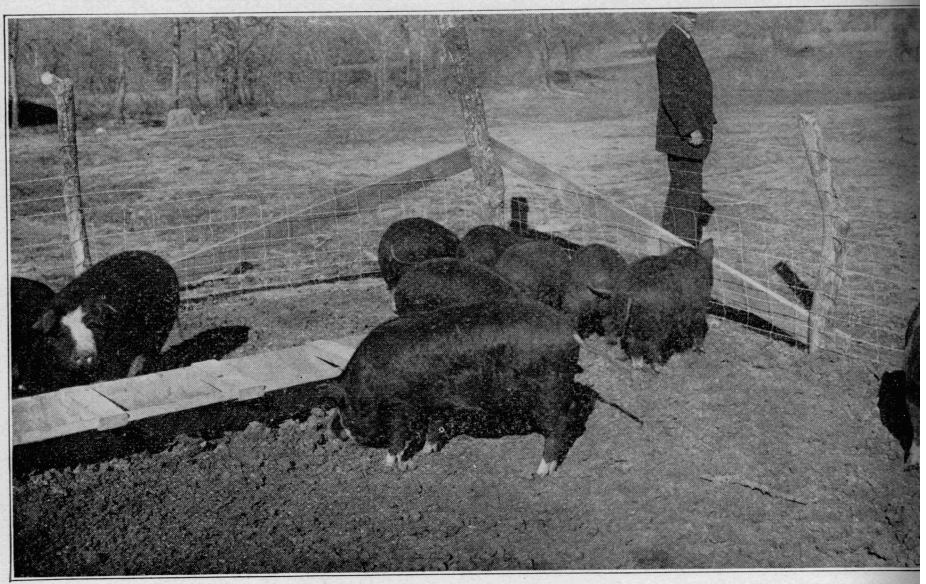
The most striking feature between these two lots is the difference in the cost of production. It cost 1.86 cents more per pound to produce a pound of pork in Lot III than in Lot II, regardless of the fact that Lot III ate 1.12 pounds per pig per day more than the pigs in Lot II. Both lots were fed rice, while Lot II received cottonseed meal and Lot III received tankage. Therefore, it is evident that the high cost of production in Lot III is due to the tankage.

Tankage cost $38 and cottonseed meal cost $30 per ton, respectively, leaving a difference of $8.00 in favor of Lot II. In our opinion, this difference in the cost of tankage and cottonseed meal is not sufficient to justify the high cost of producing a pound of pork in Lot III, while the pigs in Lot III ate their feed at all times. It may be that if we had fed less tankage per day their gains would have been equally as good and possibly better, and, therefore, would have been produced at a less cost. Tankage is possibly equal to cottonseed meal as a feed for pigs; at any rate, the feeder is not confronted with that feeling of uneasiness that has thus far been associated with the feeding of cottonseed meal; an uneasiness that may not be justifiable, and that we hope further experience will entirely remove.

On April 28th one piggy sow weighing 180 pounds was taken out of Lot III.



Hogs fed cottonseed meal and rough red rice. Average daily gain 1.26 pounds.



Hogs fed alfalfa meal and corn chops, fermented. Average daily gain, 1.14 pounds

TABLE IV.—FEED EATEN AND GAINS MADE BY LOT IV RECEIVING ALFALFA MEAL AND ROUGH RED RICE FERMENTED.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Average daily gain.	Lbs. feed per lb. gain.	Cost per lb. gain.	Balance.
8	105.5 lbs.	4116 lbs. rice; 5824 lbs. alfalfa.	926 lbs.	1.26 lbs.	4.5 lbs. rice; .8 lb. alfalfa.	8.08 cts.	$ 49 39

TABLE V.—FEED EATEN AND GAINS MADE BY LOT V RECEIVING ALFALFA MEAL AND CORN CHOPS FERMENTED.

No. of hogs.	Average weight Feb. 3.	Total feed eaten.	Total gain.	Average daily gain.	Lbs. feed per lb. gain.	Cost per lb. gain.	Balance.
7	101 lbs.	4390 lbs. corn chops; 55 lbs. alfalfa meal.	862 lbs.	1.14 lbs.	5.4 lbs. corn chops; .77 lb. alfalfa.	11.02 cts.	$ 23 13

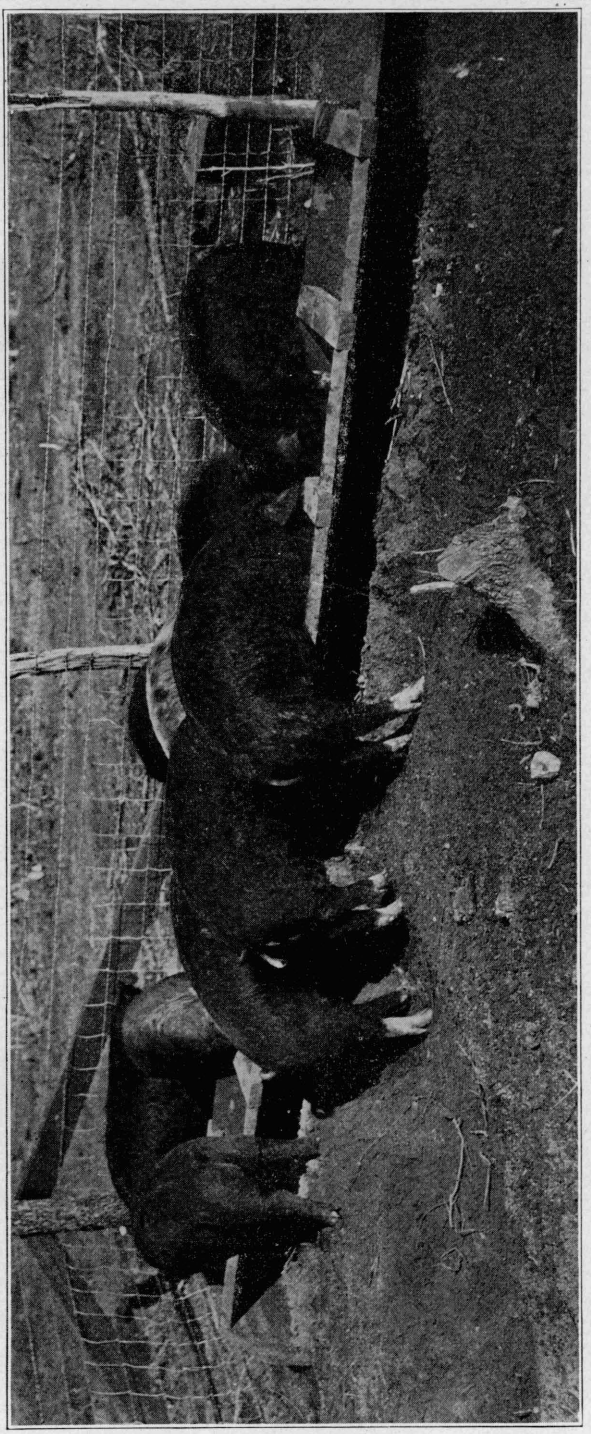
Tables IV and V, like I and II, give a comparison of corn chops and ground rough red rice. Strange to say, Lot I, receiving corn chops and cottonseed meal, gave better results than Lot II, receiving ground rough red rice and cottonseed meal, while Lot IV, receiving alfalfa meal and ground rough red rice, gave better results than Lot V, receiving alfalfa meal and corn chops. However, in the case of Lots I and II, the difference in the cost of producing a pound of pork was only 1.18 cents in favor of Lot I, and the difference in cost of production in favor of Lot IV, over Lot V, was 2.94 cents per pound. Therefore, a study of the tables would seem to place rough ground rice about equal to corn chops when fed with cottonseed meal, and better than corn chops when fed with alfalfa meal, for the production of pork.

Since it is a fact that a fattening animal receiving most near the standard ration will, as a rule, make better gains than one whose ration does not conform to the standard, it is not difficult to understand why the pigs receiving alfalfa meal and ground rough rice made better and more economical gains than the pigs receiving alfafa meal and corn chops. This difficulty could not be avoided, since a pound of alfalfa meal per day was all that the pigs would consume. Therefore, any extra feed added would have to be corn chops or ground rough rice, and the more of these feeds added the further away from the standard ration; and, since corn contains a higher per cent of carbohydrates than the rough rice, it is quite evident that the pigs receiving the ground rough rice and alfalfa meal were getting a ration more nearly approaching the standard. The same explanation applies to Lots I and II, receiving cottonseed meal and corn chops, and cottonseed meal and ground rough rice, respectively. The ration for Lot I was a little wide, while that for Lot II was narrow.

SUMMARY.

1. The lots receiving most nearly the standard ration made the largest and most economical gains.

2. Ground rough red rice fed with cottonseed meal is an economical ration for fattening hogs.



Hogs receiving corn chops and cottonseed meal. Average daily gain, 1.8 pounds.

3. Ground rough red rice fed with alfalfa meal gave better results than corn chops fed with alfalfa meal.

4. During these experiments the hogs were lot-fed, the feeding season extending well up into the hot weather (May 10th), consequently they were fed under conditions making the experiment more severe than it would have been had the experiment commenced earlier in the winter.

5. At no time during the experiment were there any injurious effects from the feeding of cottonseed meal.